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(54) Electronic device and method of cloning

(57) A method of cloning an electronic device such as a two-way radio (10) having a processor (36) and having data stored in memory (37), where the processor operates according to the stored data. The device is connected to a second, similar electronic device (20); and a program is executed in the first device which causes copying of data into the second device (clone) and which causes de-activating of the first device (destroy), thereby avoiding the co-existence of two identical devices and facilitating servicing.

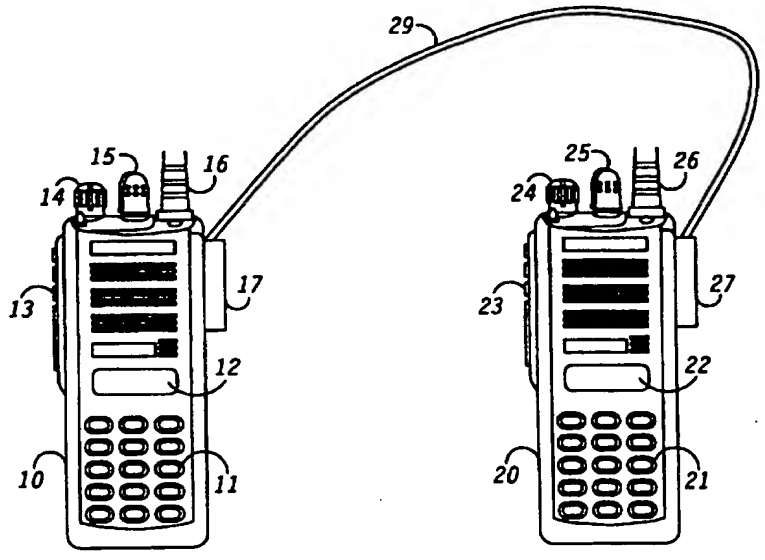

FIG. 1

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

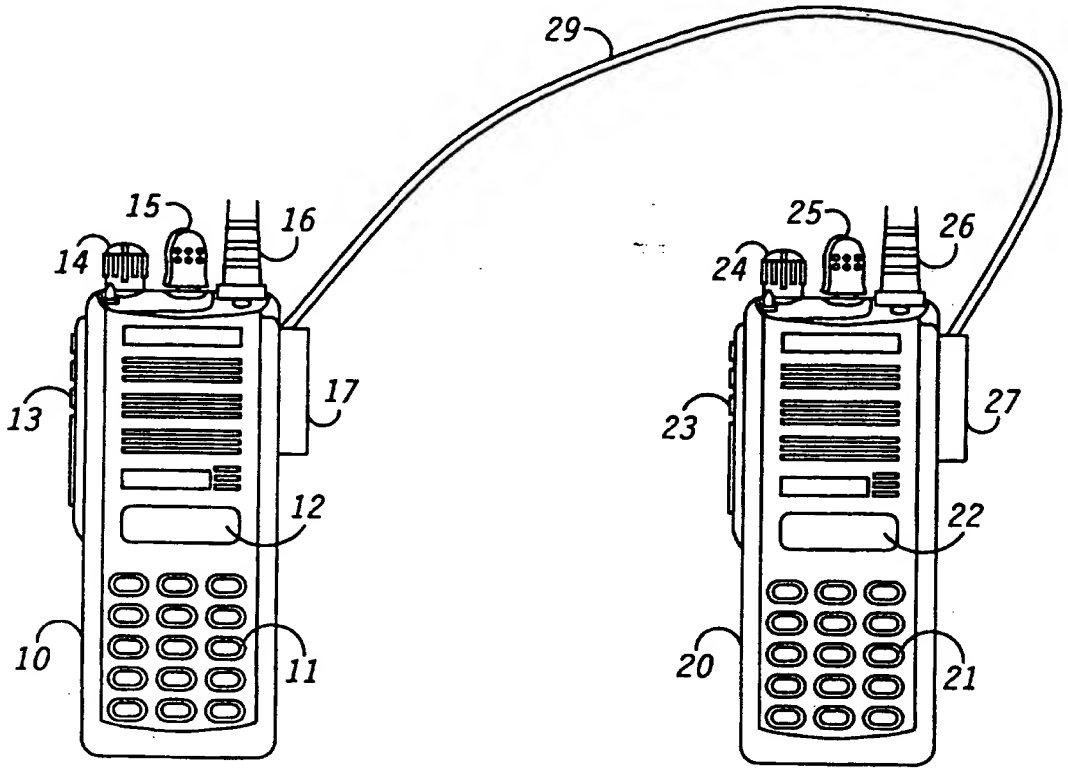

FIG. 1

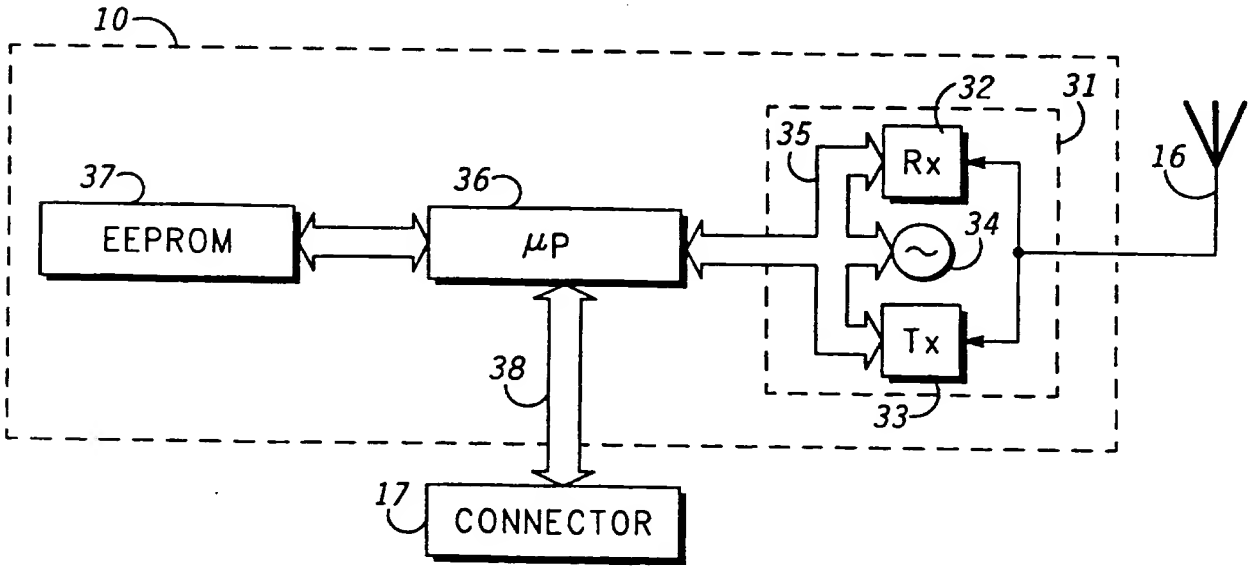

FIG. 2

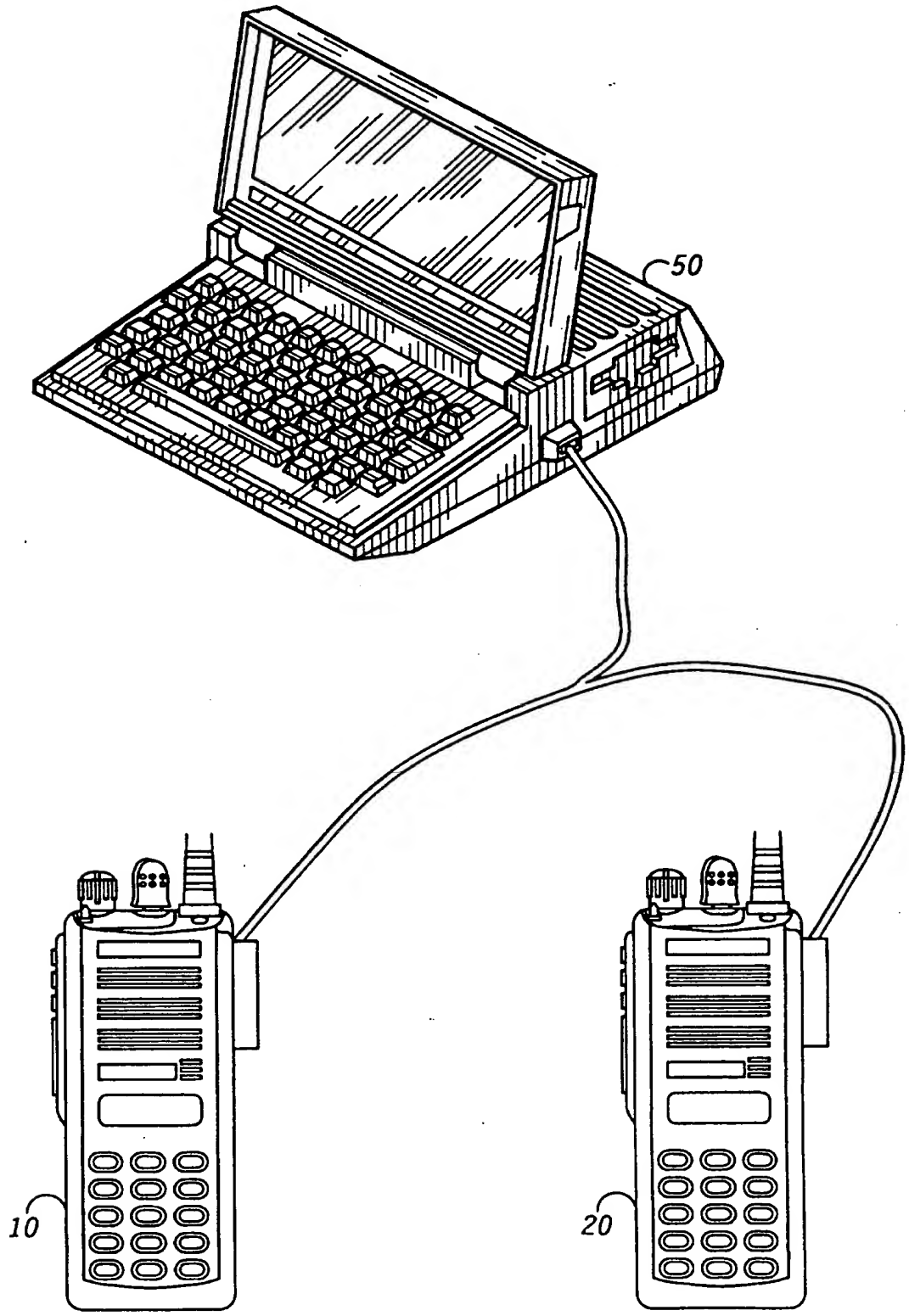

FIG. 3

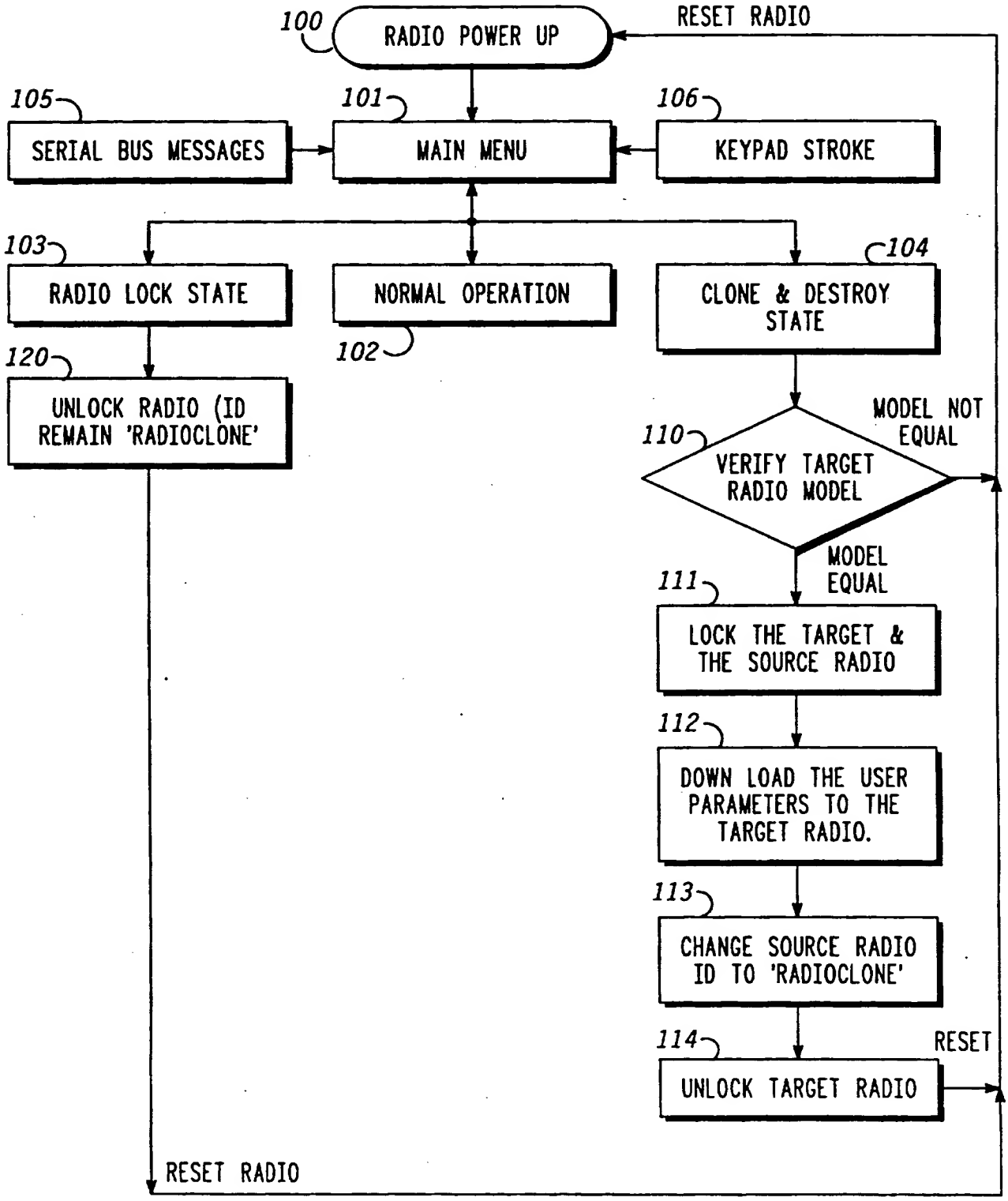

FIG. 4

ELECTRONIC DEVICE AND METHOD OF CLONING

Field of the Invention

This invention relates to an electronic device having a processor and having stored data and it relates to a method of operation of such a device, particularly for the purposes of service and repair. The invention is applicable to many examples of electronic equipment on the market place, where stored parameters define the characteristics of the particular device and examples include, but are not limited to, two-way radios, pagers and cellular radio telephones.

Background to the Invention

Certain types of electronic equipment require programming at the point-of-sale according to particular customer requirements or particular local specifications. Examples are two-way radios (trunking or conventional), where parameters such as radio frequencies have to be programmed according to the particular frequencies available for allocation to the user of the radio. The sale and repair of such equipment has to be conducted through carefully controlled channels by trained operators, so that unlicensed frequencies are not programmed into radios either by accident or by abuse.

The parameters which are specific to a given radio are generally programmed into a non-volatile memory, known as a "codeplug". Other examples of parameters stored in the codeplug are: private line tones, select call signalling calls, user personality features (volume control etc.).

From statistical measurements it has been discovered that in most cases in which two-way radios are returned to a service shop through damage, the controller section of the radio remains operational and has the ability to communicate via its serial bus. It is also found that most instances of damage require returning of the radio to a central service shop for skilled repair. Returning of the radio deprives the customer of his product for the period of repair.

It is not convenient to reprogram a new radio for issuing to the customer, because the exact details of the original radio may not be available at the point of repair, or programming of a new radio may require additional skill at the point of repair and may introduce the possibility of error in issuing the new radio. For this reason an operation

known as "cloning" is carried out, in which certain parameters of a device (e.g. a radio) are copied across to a new device (e.g. a radio).

Cloning introduces the risk that two radios may exist with the same parameters which might later give rise to conflict or confusion, for example in the case where the original radio is repaired and returned to the customer without the clone radio being returned or de-programmed. There is a need for a more secure arrangement or an arrangement which is more robust against mistakes and confusion.

Summary of the Invention

According to the present invention, a method is provided of cloning an electronic device having a processor and having stored data, where the processor operates according to the stored data. The method comprises the steps of connecting the device to a second, similar electronic device; and executing a program in the first device which causes copying of data into the second device and which causes de-activating of the first device.

The device may be a two-way radio.

The second device may be similar in functional respects, with the exception that stored parameters for control of the second radio may be absent or different to those of the first device prior to execution of the programming the first device and copying of the data into the second device.

By deactivating the first device, an unauthorised user is not able to merely duplicate the first device. This is important for security purposes, in terms of protecting from pirating and, in the case of radios, maintaining control over the ability for every radio in the field to be unique.

The cloning step gives the second device the functionality that the first device had before cloning.

As a preferred further step, the executing of the program causes the storing of an indicator in a non-volatile memory in the first device indicating that the program has been executed. This indicator serves to show that the device has been cloned. This usefully serves as an indicator to the service shop that the device should not be reissued to the customer without return of the clone device.

The first device is deactivated to the extent that it cannot be reactivated without external equipment or software.

Preferably, by external means, the first device can be reactivated, such that the program can again be executed.

It is a matter of design choice as to whether the indication in the first device is erased at a later date, or whether further indications are stored on each occasion of the program being executed and the device being cloned.

The method may comprise a first step of identifying that the electronic device is faulty.

In accordance with another aspect of the invention, an electronic device is provided comprising operating circuits, a processor, a non-volatile memory and a connector for connecting to a second electronic device. The processor comprises a first set of programmed tasks for operation of the device, said tasks causing the processor to read data from the non-volatile memory and to control the operating circuits in accordance with the data read. The processor additionally has a second set of programmed tasks for outputting of the data from the non-volatile memory to the connector and a third set of programmed tasks for locking the device and preventing further operation of the operating circuits, where the third set of tasks is executed when the second set is executed.

The device is preferably a two-way radio.

Preferred embodiments of the invention will now be described, by way of example only, with reference to the drawings.

Brief Description of the Drawings

FIG. 1 shows a first radio in accordance with the invention connected to a second, similar radio.

FIG. 2 shows details of either radio of FIG. 1.

FIG. 3 shows an arrangement alternative to that of FIG. 1.

FIG. 4 is a flow diagram illustrating programs operated by the microprocessor of the radio of FIG. 2.

Detailed Description of the Drawings

Referring to FIG.1, the first radio 10 is shown having a keypad 11 (optional), a display 12 (also optional), radio operating switches 13, 14 and 15, an antenna 16 and a connector 17. Radio 10 will be referred to as the "source radio".

Also shown in FIG. 1 is a second radio 20 having all the elements 11 to 17 of the first radio 10, numbered as elements 21 to 27 respectively. Connected between connector 17 of radio 10 and connector 27 of radio 20 is a cable 29. The second radio 20 will be referred to as the "target radio".

Details of the radio 10 are shown in FIG. 2. As can be seen, it comprises operational radio circuitry 31 comprising transmitter circuitry 32, receiver circuitry 33 and oscillator circuitry 34. The transmitter circuitry 32, oscillator circuitry 34 and receiver circuitry 33 are connected via a bus 35 to a microprocessor 36. The arrangement illustrated and described within the radio circuitry 31 is given for the purposes of illustrating an example of operation. Many different arrangements can be provided for radio circuitry 31. For example, the radio may be a receiver only having no transmitter circuitry 32 or indeed may be a transmitter with no receiver circuitry 33.

Connected to the microprocessor 36 is an electrically programmable read only memory 37. Memory 37 may include the "codeplug". The expression "codeplug" is sometimes used to refer to the entire EEPROM circuitry 37. The connector 17 is connected to the microprocessor 36 via a serial bus 38, although it will be appreciated that a parallel bus could equally be used.

In normal operation, the microprocessor 36 looks up parameters in the EEPROM 37, such as radio frequencies, and uses these parameters to control the transmitter circuitry 32 and the receiver circuitry 33. An example of such operation is the loading via the bus 35 of a value into the oscillator circuitry 34 causing the oscillator circuitry 34 to operate the transmitter circuitry 32 and the receiver circuitry 33 at particular transmit and receive frequencies. The value may, for example, be loaded into the divider of a phase lock loop within oscillator circuitry 34, but such details need not be described. Other examples of operation include the generation of tones by the microprocessor 36 for transmission through the transmitter circuitry 32 and the antenna 16, where the particular tones are selected according to the data stored in the EEPROM 37. Other examples of operation can be considered by one skilled in the art without detailed explanation.

When the radio 10 is considered to be faulty, whether the fault has been diagnosed or is merely suspected, it is connected via cable 29 to a new target radio 20. The target radio 20 may have an unprogrammed codeplug

37 or may have a codeplug which is programmed with data which is to be erased during the operation of cloning.

The technician puts the source radio into "clone mode" by pressing a simple key sequence via keypad 11 or operating switches 13 or both. This is done whilst the radio is in a power-up sequence, for example by initiating a reset or by disconnecting the battery (not shown) and reconnecting. In this mode, the source radio 10 establishes a connection with the target radio 20 and checks whether the target radio model number matches the source radio model number. The source radio model number is preferably stored in a permanent manner, for example in on-chip memory within the microprocessor 36. If the model numbers match, the source radio 10 starts copying its user information from its EEPROM 37 to the corresponding EEPROM of the target radio 20.

After finishing the copy operation, the source radio 10 "destroys" itself. Self-destruction is conducted so that the source radio will not be able to operate after power-up and no standard tool can even communicate with the source radio. Only an authorised service shop will thereafter be allowed to reinitialise the user information and repair the radio. A dedicated utility (radio service software) is provided for this purpose and is described below. The commencement of this self-destruction procedure starts at a time unknown to the user.

The operation can be performed directly from one radio to another radio, as shown in FIG. 1, with data being transferred directly from the source radio connector 17 to the target radio connector 27, or as alternative, the arrangement of FIG. 3 can be used.

In the arrangement of FIG. 3, the radio 10 is connected to the radio 20 via a computer 50. The computer 50 retrieves the user data from the source radio 10 and then transfers it to the target radio 20. It is still the case that the source radio 10 "destroys" itself.

Reference is now made to FIG. 4 for details of the program performed by the microprocessor 36 of the source radio 10.

Upon powering up of the radio (step 100) the processor 36 places the radio in a "main menu" state, from which various operations or tasks can be executed. In the main menu state 101 an indication on the display 12 shows the various options available to the user in operation. From the main menu state 101, the radio can enter normal operation 102 or radio lock state 103 or clone and destroy state 104. The entering of the states depends upon serial bus messages 105 received via the serial bus 38 or

keypad strokes 106 input to the keypad 11 or operating switches 13 or both. Normal operation involves entering of keypad strokes via the keypad and performing of transmit and receive functions within the normal operation box 102. The program can return from normal operation 102 to the main menu 101. By means of a predetermined keypad stroke (for example three simultaneous keys for a certain sequence of keys) the program proceeds from step 101 to the clone and destroy state 104. In this state, a number of tasks are executed.

The program verifies that target radio model is equal to the source radio model in step 110. If the radio models are not equal, a reset is triggered and the program returns to the radio power up mode 100. If the radio model numbers are equal, the program proceeds to task 111, where the target and source radios are locked. The target radio is locked by outputting a predetermined dedicated serial bus message via the cable 29. Any control message not used for another purpose will suffice as the predetermined dedicated serial bus message. The source radio is locked internally, for example by storing a lock code in the EPROM 37. From task 111 the program proceeds to task 112, where the user parameters are down-loaded from the source radio to the target radio. Following down-loading of these parameters, task 113 causes the source radio identification number (ID) to be changed to "radio clone". This ID is stored in EEPROM 37. Following this task, task 114 causes the target radio to be unlocked by outputting of another predetermined dedicated code via the connector 27. On completion of task 114, the source radio is reset and the program returns to step 100. Note that the target radio has been unlocked but the source radio remains in the locked state.

In cases where a radio is in the locked state, upon radio power up, the program proceeds direct from step 101 to step 103. In this state, it is necessary for a predetermined dedicated serial bus message to be received via the serial bus 38 or the source radio 10 for task 120 to enable the radio to be unlocked. Note that the identification number is not changed and continues to show that the radio has been subject to a cloning operation. Following step 120, an automatic reset takes place and the program returns to step 100.

The arrangement described has the advantage of enabling direct transfer of all user information from one two-ways subscriber radio (for other electronic device) to another, in a very simple to operate quick and secure way.

The arrangement avoids the possibility of having two operational subscriber radios with the same serial number.

The arrangement reduces significantly the radio repairing cycle time for all major faults encountered.

By destroying the source radio, only an authorised service shop is allowed to reinitialised the user information and enable the radio to operate.

Claims

1. A method of cloning an electronic device having a processor and having data stored in memory, where the processor operates according to the data, comprising the steps of:

connecting the device to a second, similar electronic device; and

executing a program in the first device which causes copying of data into the second device and which causes deactivating of the first device.

2. A method according to claim 1, wherein the step of executing the program causes deactivation of the first device including at least prevention of reactivation of the program.

3. A method according to claim 1 or claim 2 wherein the step of executing the program includes storing an indication in the first device that the program has been executed.

4. An electronic device comprising operating circuits, a processor, a non-volatile memory and a connector for connecting to a second electronic device, where the processor comprises:

a first set of program tasks for operation of the device, said tasks causing the processor to read data from the non-volatile memory and to control the operating circuits in accordance with the data read;

a second set of program tasks for outputting of the data from the non-volatile memory to the connector; and

a third set of program tasks for locking the device and preventing further operation of the operating circuits, where the third set of tasks is executed when the second set is executed.

5. A radio comprising operating circuits, a processor, a non-volatile memory and a connector for connecting to a second radio, where the processor comprises:

a first set of program tasks for operation of the radio, said tasks causing the processor to read data from the non-volatile memory and to control the operating circuits in accordance with the data read;

a second set of program tasks for outputting of the data from the non-volatile memory to the connector; and

a third set of program tasks for locking the radio and preventing further operation of the operating circuits, where the third set of tasks is executed when the second set is executed.

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Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

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Relevant Technical Fields

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(ii) Int Cl (Ed.6) G06F 1/00, 12/14

Search Examiner
PAUL NICHOLLS

Date of completion of Search
16 JANUARY 1995

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii)

Documents considered relevant following a search in respect of Claims :-
1-5

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
Y	GB 2253545 A	(MOTOROLA) see page 2	1-5
Y	EP 0174472 A2	(IBM) whole document	1-5
Y	EP 0119886 A1	(HONEYWELL BULL) whole document	1-5

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